



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,134	02/06/2006	Masahiko Igarashi	025416-00026	4553
4372	7590	01/07/2009		
ARENT FOX LLP 1050 CONNECTICUT AVENUE, N.W. SUITE 400 WASHINGTON, DC 20036				
EXAMINER				
GARCIA, ERNESTO				
ART UNIT		PAPER NUMBER		
3679				
NOTIFICATION DATE		DELIVERY MODE		
01/07/2009		ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

DCIPDocket@arentfox.com
IPMatters@arentfox.com
Patent_Mail@arentfox.com

Office Action Summary

Application No.

10/567,134

Applicant(s)

IGARASHI ET AL.

Examiner

ERNESTO GARCIA

Art Unit

3679

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 September 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 7-14 and 17-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 15 and 16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 September 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 9/5/08.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Election of Species

Claims 7-14 and 17-19 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on September 24, 2008.

Drawings

The drawings were received on September 24, 2008. These drawings are accepted. However, the drawings still contain discrepancies.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "22" and "22' " have both been used to designate the same shaft tooth section in Figure 1 and 15.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "22b₁" and "22b₂" have both been used to designate the same valley in Figure 1.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "22b₅" and "22b₆" have both been used to designate the same valley in Figure 33.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "22a" and "22a'" have both been used to designate the same crowned peak in both Figures 1 and 23.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "28₁" and "28₂" have both been used to designate the same hub tooth section in Figure 1.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "28₅" and "28₆" have both been used to designate the same hub tooth section in Figure 33.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "22" has been used to designate both a shaft with a first

configuration (Figure 3) and another shaft with another configuration (Figure 3; slanted first step region with a smaller angle; page 5, lines 19-21). Note that these shafts are not the same to be designated with the same reference character "22". The simple rule is to designate the same part with the same reference character. Also note that the shaft shanks 24 are different. The one in Figure 3 is slanted while the one in Figure 4 is not. The same applies to Figure 5 with respect to the shaft as this is a different shaft than those found in Figures 3 and 4. The shaft in Figure 5 and Figure 38 is not the same one as shown in Figures 3 and 4 and should be deigned with another reference character. The same applies to the shaft shank shown in Figure 35-37

The drawings are objected to because reference character "28" in Figure 2A and 2B should be --28₁-- as these figures represent a cross-section of Figure 1 which shows a hub tooth section labeled 28₁. Figures 12-14 are not a representation of the cross-sections shown in Figure 3 since some of the reference characters do not match. In particular, reference characters 28₁ and 22 are inconsistent. The same applies to cross-sections shown in Figures 20-22 and 37-39. Note that the reference characters are not inconsistent. In reviewing Figure 2A and 2B, it is unclear why the splines on the hub are closer together as compared to those in Figure 2A. Figure 2B shows the splines of the hub being closer than those in Figure 2A and thus the examiner questions what is going on with the splines on the hub. Further, the drawings should identify the tooth thickness, in particular, the maximum tooth thickness at a crowning top, as claimed in claim 5.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the direction from the crowning top (claim 6, line 6) must be shown or the feature canceled from the claim. No new matter should be entered. Note that no arrows have been shown to indicate the direction or that it is from the crowning top.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended". If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The description on the embodiment in Figure 1 in the amended paragraph is incorrect as this figure no longer has reference character 12 or 14. Note that Figure 1 rather shows "12₁" and "14₁".

The description of reference character "22a" is inconsistent. It has been described as a convex peak at page 12, line 23, and a crowned peak at page 20, lines 15-16.

The description of reference character "28a" is inconsistent. It has been described as a convex peak at page 13, lines 16-17, and a straight peak at page 20, lines 16-17.

The new reference character "22b₁" in the amended specification does not reflect amended Figure 3. Note that "b₁" in Figure 3 has been rather subscripted.

Claim Objections

Claims 1, 6, 15, and 16 are objected to because of the following informalities:
regarding claim 1, --further-- should be inserted before "comprising" in line 2 as "including" in line 1 is the synonymous to "comprising" and thus the mechanism further

includes the shaft tooth section and everything that follows line 3, and --straight-- should be inserted before "peak" in line 12;

regarding claim 6, the first occurrence of "the" in line 7 should be --a--; and,

regarding claims 15 and 16, --crowned-- should be inserted before "peak" in line

2. Appropriate correction is required. For purposes of examining the instant invention, the examiner has assumed these corrections have been made.

Claim Rejections - 35 USC § 112

Claims 1-6, 15, and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, the metes and bounds of the claim is unclear. If the shaft and the hub make up the mechanism, how does both the shaft and hub transmit torque between the shaft and the hub? It seems that the shaft should rather be recited such that the shaft transmits torque to the hub or vice versa and not to itself.

Regarding claim 5, the recitation "the varying radial tooth thickness" in lines 1-2 lacks proper antecedent basis. Further, is "an axial direction" in lines 3-4 another axial direction than that recited in claim 1, lines 15?

Regarding claim 6, the recitation "in an area that is displaced" in line 2 makes unclear where the area is located. Further, it is unclear where the "applied load" is applied at line 7.

Regarding claims 2-5, 15, and 16, the claims depend from claim 1 and therefore are indefinite.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 5, 6, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beigang, 6,142,033, in view Shigeru, JP2001-287122.

Regarding claim 1, Beigang discloses, in Figures 1 and 2, a mechanism comprising a shaft **1** and a hub **2**. The hub **2** is disposed around the shaft **1** while holding a shaft tooth section **5** formed on the shaft **1**. The hub **2** has a hub tooth section **7** in engagement with the shaft tooth section **5**. The shaft tooth section **5** has a crowned peak and a valley **A2** (see marked-up attachment provided in the last Office action). The valley **A2** has an outside diameter varying from an end thereof toward a shaft

shank **4** of the shaft **1**. The hub tooth section **7** has a straight peak **A4** and a valley **A5**. The straight peak **A4** opposes and engages the valley **A2** of the shaft tooth section. The straight peak **A4** has a constant tooth thickness along an axial length and an inside diameter varying from an end of the shaft toward the shaft shank **4**. The valley **A5** of the hub tooth section **5** has a constant inside diameter in an axial direction of the shaft **1**. However, Beigang fails to disclose the crowned peak having a varying tooth thickness along an axial length of the crowned peak. Shigeru teaches, in Figures 8 and 9, a crowned peak having a varying tooth thickness along an axial length of the crowned peak to reduce stress concentrations (see machine English translation [010]). Therefore, as taught by Shigeru, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the crowned peak of Beigang with a varying tooth thickness along an axial length of the crowned peak to reduced stress concentrations.

Regarding claim 2, a changing point of the outside diameter of the valley **A2** of the shaft tooth section **5** and a changing point of the inside diameter of the peak **A4** of the hub tooth section **7** are set in respective positions which are offset from each other in the axial direction of the shaft **1** (see towards the left side of Figure 1 which is the front of the joint).

Regarding claim 5, the tooth thickness of the crowned peak comprises a maximum tooth thickness at a crowning top **O₁** and progressively decreases in an axial

direction from the crowning top toward opposite ends of the crowned peak (note that Figure 9 shows at the high peak of ramp 74 to be the crowning top and reduces in both directions due to the tapers).

Regarding claim 6, the shaft tooth section and the hub tooth section mesh with each other in an area that is displaced in a direction from the crowning top toward the shaft shank as an applied load increases on the crowned peak (this is due to the press fit as the splines plastically deform slightly, each being compressed against the other).

Regarding claim 15, the crowned peak of the shaft tooth section has an outside diameter which varies in the axial direction of the shaft 1.

Claims 1, 2, 5, 6, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stall et al., 5,779,551, in view Shigeru, JP2001-343023.

Regarding claim 1, Stall et al. disclose, in Figure 1, a mechanism comprising a shaft 1 and a hub 3. The hub 3 is disposed around the shaft 1 while holding a shaft tooth section 6 formed on the shaft 1. The hub 3 has a hub tooth section 14 in engagement with the shaft tooth section 6. The shaft tooth section 6 has a crowned peak and a valley 7. The valley 7 has an outside diameter varying from an end thereof toward a shaft shank 5 of the shaft 1. The hub tooth section 14 has a straight peak and a valley. The straight peak opposes and engages the valley of the shaft tooth section 6.

The straight peak has a constant tooth thickness and an inside diameter varying from an end thereof toward the shaft shank. The valley of the hub tooth section has a constant inside diameter in the axial direction of the shaft 1. However, Beigang fails to disclose the crowned peak having a varying tooth thickness along an axial length of the crowned peak. Shigeru teaches, in Figures 8 and 9, a crowned peak having a varying tooth thickness along an axial length of the crowned peak to reduce stress concentrations (see machine English translation [010]). Therefore, as taught by Shigeru, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the crowned peak of Beigang with a varying tooth thickness along an axial length of the crowned peak to reduced stress concentrations.

Regarding claim 3, the valley of the shaft tooth section has a first step region (at 7) raised toward the hub tooth section. The peak of the hub tooth section has a second step region retracted away from the shaft tooth section (near 4). A starting point of the first step region and a starting point of the second step region are set in respective positions which are offset from each other by a predetermined distance.

Regarding claim 4, the first step region of the shaft tooth section has a tilt angle set to a value ranging from 5 degrees to 45 degrees.

Regarding claim 15, the crowned peak of the shaft tooth section has an outside diameter which varies in the axial direction of the shaft 1.

Regarding claim 16, the crowned peak of the shaft tooth section **6** has an outside diameter which gradually decreases toward the shaft shank **5**.

Claims 1, 2, 5, 6, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beigang, 6,142,033, in view Shigeru, JP2001-343023.

Regarding claim 1, Beigang discloses, in Figures 1 and 2, a mechanism comprising a shaft **1** and a hub **2**. The hub **2** is disposed around the shaft **1** while holding a shaft tooth section **5** formed on the shaft **1**. The hub **2** has a hub tooth section **7** in engagement with the shaft tooth section **5**. The shaft tooth section **5** has a crowned peak and a valley **A2** (see marked-up attachment provided in the last Office action). The valley **A2** has an outside diameter varying from an end thereof toward a shaft shank **4** of the shaft **1**. The hub tooth section **7** has a straight peak **A4** and a valley **A5**. The straight peak **A4** opposes and engages the valley **A2** of the shaft tooth section. The straight peak **A4** has a constant tooth thickness along an axial length and an inside diameter varying from an end of the shaft toward the shaft shank **4**. The valley **A5** of the hub tooth section **5** has a constant inside diameter in an axial direction of the shaft **1**. However, Beigang fails to disclose the crowned peak having a varying tooth thickness along an axial length of the crowned peak. Shigeru teaches, in Figures 8 and 9, a crowned peak having a varying tooth thickness along an axial length of the crowned peak to avoid backlash, noise, and vibration (see machine English translation [002]).

Therefore, as taught by Shigeru, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the crowned peak of Beigang with a varying tooth thickness along an axial length of the crowned peak to avoid backlash, noise, and vibration.

Regarding claim 2, a changing point of the outside diameter of the valley **A2** of the shaft tooth section **5** and a changing point of the inside diameter of the peak **A4** of the hub tooth section **7** are set in respective positions which are offset from each other in the axial direction of the shaft **1** (see towards the left side of Figure 1 which is the front of the joint).

Regarding claim 5, the tooth thickness of the crowned peak comprises a maximum tooth thickness at a crowning top **O₁** and progressively decreases in an axial direction from the crowning top toward opposite ends of the crowned peak (note that Figure 9 shows at the high peak of ramp **74** to be the crowning top and reduces in both directions due to the tapers).

Regarding claim 6, the shaft tooth section and the hub tooth section mesh with each other in an area that is displaced in a direction from the crowning top toward the shaft shank as an applied load increases on the crowned peak (this is due to the press fit as the splines plastically deform slightly, each being compressed against the other).

Regarding claim 15, the crowned peak of the shaft tooth section has an outside diameter which varies in the axial direction of the shaft 1.

Claims 1, 2, 5, 6, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stall et al., 5,779,551, in view Shigeru, JP2001-343023.

Regarding claim 1, Stall et al. disclose, in Figure 1, a mechanism comprising a shaft 1 and a hub 3. The hub 3 is disposed around the shaft 1 while holding a shaft tooth section 6 formed on the shaft 1. The hub 3 has a hub tooth section 14 in engagement with the shaft tooth section 6. The shaft tooth section 6 has a crowned peak and a valley 7. The valley 7 has an outside diameter varying from an end thereof toward a shaft shank 5 of the shaft 1. The hub tooth section 14 has a straight peak and a valley. The straight peak opposes and engages the valley of the shaft tooth section 6. The straight peak has a constant tooth thickness and an inside diameter varying from an end thereof toward the shaft shank. The valley of the hub tooth section has a constant inside diameter in the axial direction of the shaft 1. However, Beigang fails to disclose the crowned peak having a varying tooth thickness along an axial length of the crowned peak. Shigeru teaches, in Figures 8 and 9, a crowned peak having a varying tooth thickness along an axial length of the crowned peak to avoid backlash, noise, and vibration (see machine English translation [002]). Therefore, as taught by Shigeru, it would have been obvious to one of ordinary skill in the art at the time the invention was

made to make the crowned peak of Beigang with a varying tooth thickness along an axial length of the crowned peak to avoid backlash, noise, and vibration.

Regarding claim 3, the valley of the shaft tooth section has a first step region (at 7) raised toward the hub tooth section. The peak of the hub tooth section has a second step region retracted away from the shaft tooth section (near 4). A starting point of the first step region and a starting point of the second step region are set in respective positions which are offset from each other by a predetermined distance.

Regarding claim 4, the first step region of the shaft tooth section has a tilt angle set to a value ranging from 5 degrees to 45 degrees.

Regarding claim 15, the crowned peak of the shaft tooth section has an outside diameter which varies in the axial direction of the shaft 1.

Regarding claim 16, the crowned peak of the shaft tooth section 6 has an outside diameter which gradually decreases toward the shaft shank 5.

Response to Arguments

Applicants' arguments with respect to claims 1-6, 15, and 16 have been considered but are moot in view of the new grounds of rejection.

Conclusion

The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yoshihide et al., JP-02-062461, show a similar crowned peak having a varying tooth thickness along an axial length of the crowned peak.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. In particular, the new recitations "a varying tooth thickness along an axial length of the crowned peak" in claim 1, lines 8-9, and "straight peak opposing and engaging said valley of said shaft tooth section" in claim 1, lines 11-12, and "a constant tooth thickness along an axial length" in claim 1, lines 12-13, necessitated the new grounds of rejection. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ernesto Garcia whose telephone number is 571-272-7083. The examiner can normally be reached from 9:30AM-6:00PM. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Daniel P. Stodola can be reached at 571-272-7087.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

Art Unit: 3679

you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/E. G./

Examiner, Art Unit 3679

January 5, 2009

/Daniel P. Stodola/
Supervisory Patent Examiner, Art Unit 3679